Spot Safety Project Evaluation

Project Log # 200501215

Spot Safety Project # 05-99-243

Spot Safety Project Evaluation of the Directional Crossover Installation, At the Intersection of US 64 and SR 2234/ SR 2500 (Mark's Creek Road), Near Knightdale, in Wake County

Documents Prepared By:

Safety Evaluation Group
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Principal Investigator

_____ __09-16-05___
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Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 05-99-243 – The Intersection of US 64 and SR 2234/ SR 2500 (Mark's Creek Road), near Knightdale, in Wake County

Introduction

In an attempt to assess the safety of our roads, the Safety Evaluation Group of the Traffic Safety Systems Management Section has evaluated the above project. The methodologies used in this evaluation offer various philosophies and ideas, in an effort to provide objective countermeasure crash reduction results. A naive before and after analysis and an Odds Ratio comparison analysis have been completed to measure the effectiveness of the spot safety improvement. This information is provided to you so the benefit or lack of benefit for this type of project can be recognized and utilized for future projects.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the construction of raised islands in the crossover to prevent through and left turn movements from the side street approaches. A private citizen of Knightdale originally requested the improvements. US 64 is a four-lane divided roadway with two travel lanes in each direction. On the eastbound approach, an exclusive left-turn lane and a right turn lane are provided. On the westbound approach, an exclusive left-turn lane is provided. Both approaches of SR 2234/ SR 2500 (Mark's Creek Road) have a single lane approach. Prior to the improvements, southbound SR 2234/ SR 2500 (Mark's Creek Road) was a two-lane approach with a right turn lane and a thru-left turn lane. SR 2234/ SR 2500 (Mark's Creek Road) is under stop-sign control at the treatment intersection. The speed limit is 55 mph on US 64 and 45 mph on SR 2234/ SR 2500 (Mark's Creek Road).

The initial crash analysis for this location was completed from May 1, 1996 through April 30, 1999 with a total of twenty-one reported crashes. Thirteen of the twenty-one crashes were considered "correctable" and included twelve Angle Crashes and one Left Turn-Same Roadway Crash. One class A injury, five class B injuries, and twelve class C injuries resulted from the correctable crashes. The final completion date for the improvement at the subject intersection was on November 30, 2001.

Vehicles on SR 2234/ SR 2500 (Mark's Creek Road) could not enter the intersection safely due to insufficient gaps in traffic. The high traffic volumes on US 64 also created long delays for motorists turning left or going straight from SR 2234/ SR 2500 (Mark's Creek Road). According to the Project File Folder, 400 of the 49,000+ vehicles which used this intersection each day went straight or turned left from SR 2234/ SR 2500 (Mark's Creek Road). Twelve of the twenty-one crashes in the initial crash analysis were caused by motorists on SR 2234/ SR 2500 (Mark's Creek Road) making straight or turned left movements. Therefore, more than half of the crashes at the

location were being caused by less than 1 percent of the motorists at the intersection. It was felt that the directional crossover would reduce the number of crashes at the intersection with minimal impact on traffic progression along US 64. A traffic signal was not recommended because of the delay it would cause on US 64.

Comparison Analysis

After reviewing the spot safety project file folder along with all the crashes at the subject location, the crash data omitted from this analysis to consider for an adequate construction period was from October 1, 2001 through January 31, 2002. The before period consisted of reported crashes from October 1, 1998 through September 30, 2001 (3 Years) and the after period consisted of reported crashes from February 1, 2002 through January 31, 2005 (3 Years). The ending date for this analysis was determined by the available crash data at the time the crash analysis was completed.

The analysis included two different sets of data, the treatment and the comparison data. The treatment data consisted of all crashes within 150 feet of the subject intersection. The comparison data consisted of all crashes within a 0 feet Y-line on US 64, from 0.3 miles west of the treatment location to 1.1 miles west of the treatment location. Please see attached *Location Map* for further detail. The following data table depicts the Naive Before and After Analysis for the treatment and comparison information. Please note that Frontal Impact Crashes were the target crashes for the applied countermeasure. The Frontal Impact Crash types considered are as follows: Left turn, same roadway; Left turn, different roadways; Right turn, same roadway; Right turn, different roadways; Head on; and Angle.

Treatment Information

	Before	**After**	**Percent Reduction (-)/ Percent Increase (+)**
Total Crashes	21	11	- 47.6
Total Severity Index	7.08	11.25	58.9
Frontal Impact Crashes	17	4	- 76.5
Frontal Severity Index	8.51	25.50	199.6
Volume	45,000	47,600	5.8

Comparison Information

	Before	**After**	**Percent Reduction (-)/ Percent Increase (+)**
Total Crashes	39	60	53.8
Total Severity Index	3.85	4.73	22.9
Volume	43,700	46,500	6.4

Odds Ratio: Treatment versus Comparison

	Before	After	Percent Reduction (-)/ Percent Increase (+)
Treatment Total Crashes	21	11	---
Comparison Total Crashes	39	60	- 66.0 %

The naive before and after analysis at the treatment location resulted in a 47.6 percent decrease in Total Crashes, a 58.9 percent increase in the Total Severity Index, and a 5.8 percent increase in Average Daily Traffic (ADT). The comparison location experienced a 53.8 percent increase in Total Crashes, a 22.9 percent increase in the Total Severity Index, and a 6.4 percent increase in ADT. The before period ADT year was 2000 and the after period ADT year was 2003.

The Odds Ratio is used as another means of calculating the treatment effect. The number of crashes in the before and after period from the Comparison Strip are used to calculate the percent reduction in crashes for the Treatment Intersection. As shown in the previous table, using the Odds Ratio calculation, there is a 66.0 percent decrease in Treatment Intersection crashes.

Additional Analysis

In order to test for crash migration, a naïve before and after analysis was also performed at the two median crossovers (east and west of the treatment site) effected by the spot safety improvements.

The two crossovers on US 64 analyzed are as follows:
Crossover 1 – Non-intersection crossover located approximately 0.2 miles west of the Treatment
Crossover 2 – US 64 at SR 2236-Keith's Road

The data for both intersections consisted of all crashes within a 150 feet Y-line. The following table is a summary of Total Crashes at both treatment-influenced intersections. As shown below, the naive before and after analysis at the crossovers surrounding the treatment intersection resulted in a minimal change in Total Crashes.

Overall Total Crash Summary of Treatment Influenced Intersections

	Before	After	Percent Reduction (-)/ Percent Increase (+)
Treatment Intersection	21	11	- 47.6
Crossover 1	2	2	0.0
Crossover 2	9	8	- 11.1

Results and Discussion

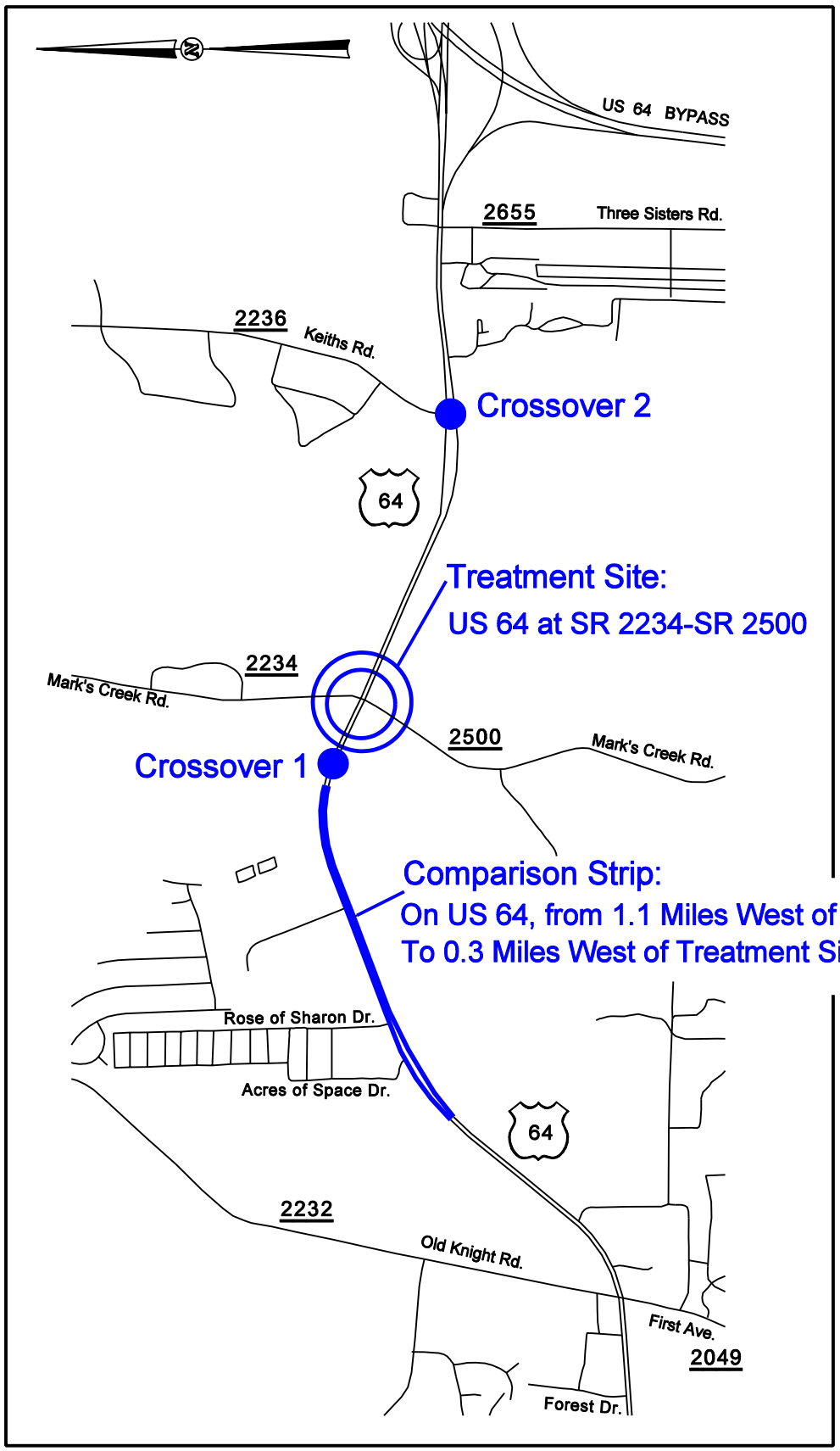
The naive before and after analysis at the Treatment Intersection resulted in a 47.6 percent decrease in Total Crashes and a 58.9 percent increase in the Total Severity Index. Analysis of the treatment location also resulted in a 76.5 percent decrease in Frontal Impact Crashes. Using the Odds Ratio to calculate the treatment effect resulted in a 66.0 percent decrease in Total Crashes at the Treatment Intersection. The summary results above demonstrate that when using both analysis methods the treatment location appears to have had a reduction in the number of crashes from the before to the after period.

The raised islands constructed in the treatment crossover prevent through and left turn movements for both side street approaches. Motorists wishing to make these movements need to find an alternative route (i.e. potential crash migration occurs). Therefore, the effect of the treatment location on the surrounding median crossovers must remain in consideration while assessing analysis of the Treatment Intersection. The naïve before and after analysis of Crossovers 1 and 2, located west and east of the treatment intersection, resulted in no change and an 11.1 percent decrease in Total Crashes, respectively. U-turn crashes at Crossovers 1 and 2 had the potential to increase in the after period because of the movements prohibited at the treatment location. The number of crashes involving U-turn movements at Crossover 1 increased from zero crashes in the before period to two crashes in after period. The number of crashes involving U-turn movements at Crossover 2 decreased from two crashes in the before period to one crash in the after period. It appears that the treatment intersection has had minimal impact on the number of crashes at the surrounding median crossover locations.

Please see the attached *Treatment Site Location Photos*. Photos are provided of the treatment intersection and of the surrounding crossover locations. Note that there is an abandoned gas station in the northwest quadrant of the treatment intersection. The date of the closure is unknown. No treatment location crashes appeared to involve vehicles accessing the gas station.

The countermeasure crash reduction for Total Crashes at the subject intersection can be in the range of a 47.6 percent decrease to a 66.0 percent decrease in crashes. The countermeasure crash reduction for Frontal Impact Crashes at the subject intersection is a 76.5 percent decrease in crashes. As the Safety Evaluation Group completes additional spot safety reviews for this type of countermeasure, we will be able to provide objective and definite information regarding actual crash reduction factors.

Location Map SS 05-99-243
Near Knightdale, Wake County



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Treatment Site Photos (Taken on August 24, 2005)

Looking east at the Treatment Location on US 64

Looking west at the Treatment Location on US 64

Treatment Site Photos (Taken on August 24, 2005)

Looking south at the Treatment Location on SR 2234-Mark's Creek Road

Looking north at the Treatment Location on SR 2500-Mark's Creek Road

Treatment Site Photos (Taken on August 24, 2005)

Looking east from SR 2234-Mark's Creek Road

Looking west from SR 2500-Mark's Creek Road

Treatment Site Photos (Taken on August 24, 2005)

Driving west on US 64 at Crossover 1 (First crossover west of the Treatment Location).

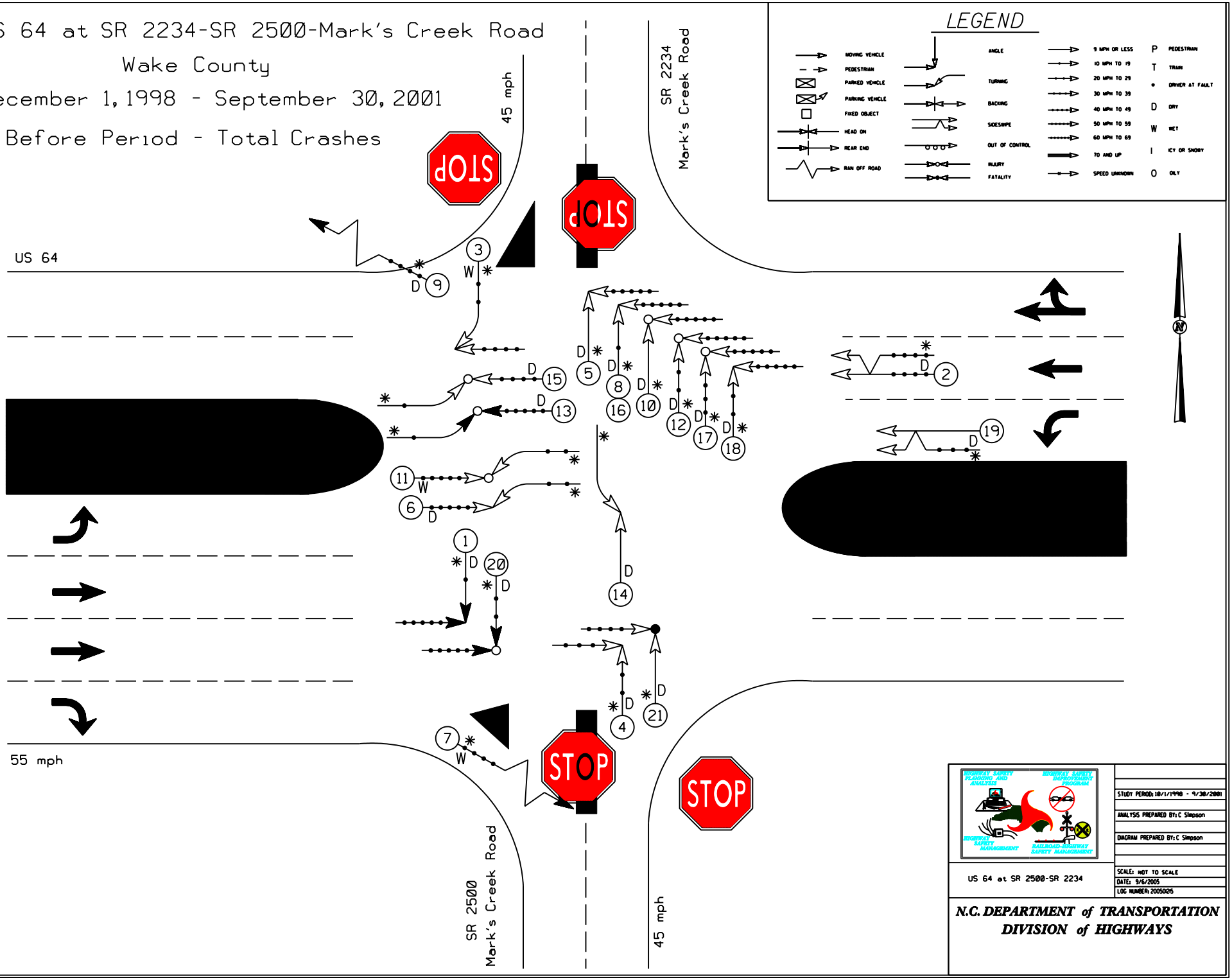
Driving east towards Crossover 2 (US 64 and SR 2236-Keith Road).

US 64 at SR 2234-SR 2500-Mark's Creek Road

Wake County

December 1, 1998 - September 30, 2001

Before Period - Total Crashes



US 64 at SR 2500-SR 2234

STUDY PERIOD: 10/1/1998 - 9/30/2001

ANALYSIS PREPARED BY: C Simpson

DIAGRAM PREPARED BY: C Simpson

SCALE: NOT TO SCALE

DATE: 9/6/2005

LOG NUMBER: 20050025

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS

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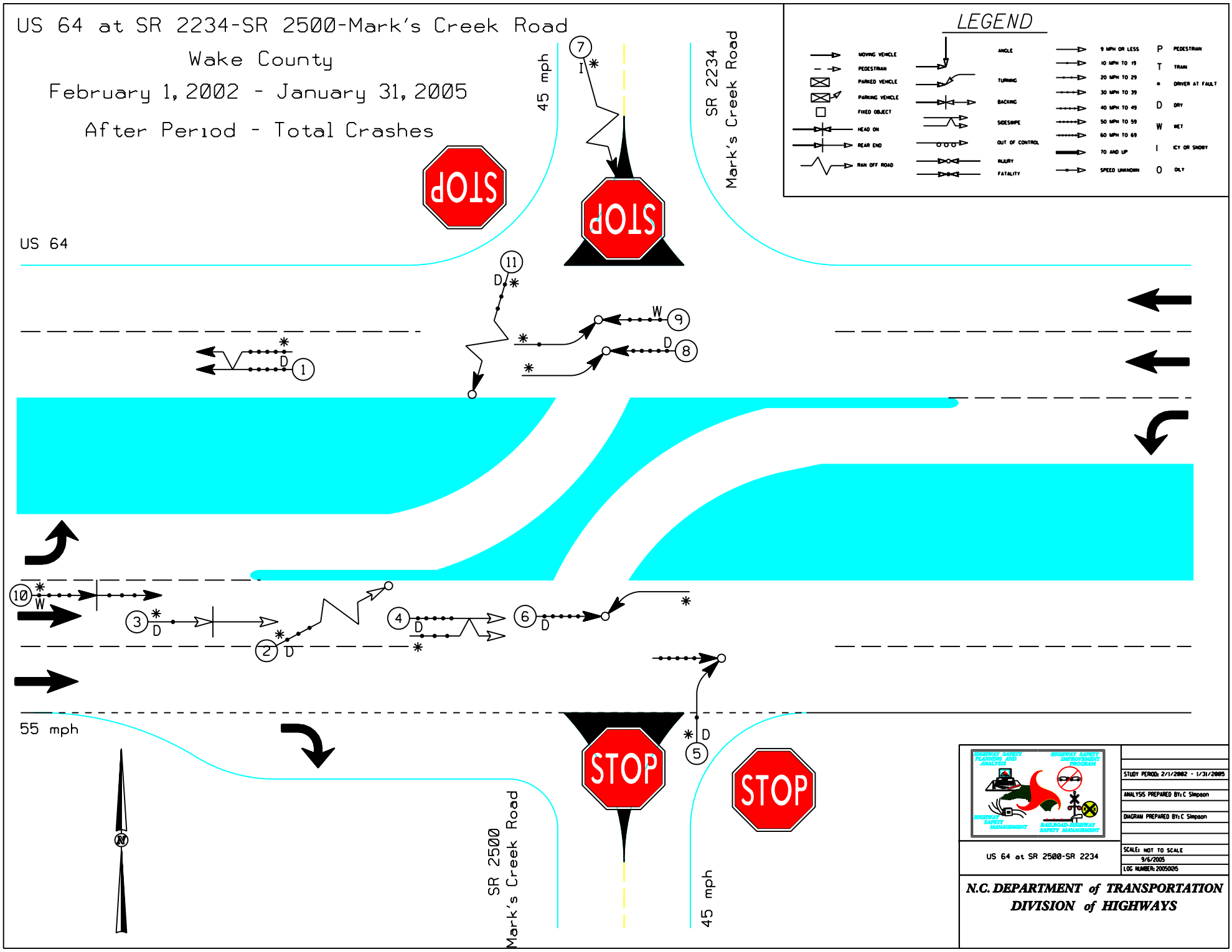
US 64 at SR 2234-SR 2500-Mark's Creek Road

Wake County

February 1, 2002 - January 31, 2005

After Period - Total Crashes



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